

## SECTION 16425

### SWITCHBOARDS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Extent of switchboard work is indicated by drawings and schedules.
- B. Types of switchboards specified in this section include the following:
  - 1. Circuit Breaker Type Switchboard

#### PART 2 - PRODUCTS

##### 2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide switchboards of one (1) of the following:
  - 1. General Electric Co.
  - 2. Siemens.
  - 3. Square D Co.
  - 4. Cutler-Hammer.
  - 5. H.K. Scholz Co.
  - 6. E.A. Pederson Co.
- B. All switchboards and panelboards shall be of the same manufacturer. The Contractor shall verify that the size of equipment supplied by the selected manufacturer does not exceed the available mounting space. (See floor plans).

##### 2.2 EQUIPMENT SECTIONS AND COMPONENTS

- A. General: Except as otherwise indicated, provide switchboards and ancillary components of types, sizes, characteristics and ratings indicated, which comply with manufacturer's standard design, materials, components and construction in accordance with published product information and as required for complete installation.
- B. Switchboards: Provide factory- assembled, dead-front, metal-enclosed, self-supporting secondary power switchboards, of types, sizes and electrical ratings and characteristics indicated; consisting of panel (vertical) units, and containing circuit breakers of quantities, ratings and types indicated. Provide silver plated copper main bus and connections to switching devices and circuit- breaker branches, with main bus and tap connections bolted tightly according to manufacturer's torquing requirements for maximum conductivity. The current density of the bus shall not exceed 1000-amperes per square inch cross-section for copper. Brace bus for short-circuit stresses up to 65,000 AIC. Provide accessibility of line and load terminations from front of switchboard. Prime and coat switchboard with manufacturer's standard finish and color. Equip units with built-in lifting eyes and yokes; and provide individual panel (vertical) units, suitable for bolting together at Project Site. Construct switchboard units for the following environment:
  - 1. Installation: Indoors, NEMA Type 1.

2. All bus shall be copper and rated for continuous current at 65 degrees C. rise above 40 degree C. ambient.
  3. Basic one-line diagram, control and layout details are shown on the attached drawings.
- C. Enclosures: Construct dead-front switchboards, suitable for floor-mounting, with front cabling/wiring accessibility, and conduit accessibility as indicated. Provide welded steel channel framework; hinge wireway front covers to permit ready access to branch circuit load side terminals. Coat enclosures with manufacturer's standard corrosive-resistant finish. Each switchgear unit shall be 36 inches wide maximum, approximately 48 inches deep and approximately 90 inches tall. The switchgear shall be shipped without the units interconnected. Switchgear shall be capable of passing thru a 36" x 84" opening or shall be shipped for and assembled in the field.
1. A ground bus shall be furnished secured to each vertical section structure and shall extend the entire length of the switchboard.
- D. Feeder circuit breaker(s) rated 800-amp and less shall be thermal-magnetic molded-case circuit breakers conforming to NEMA AB1 with 65,000-amp interrupting capacity. Circuit breaker frame sizes of 250-amp and larger shall have adjustable magnetic trip settings.
- E. Feeder circuit breaker(s) rated 1000-amp shall be electronic trip circuit breakers conforming to NEMA AB 1 with 65,000-amp interrupting capacity. The electronic trip circuit breakers shall be RMS sensing, with replaceable rating plugs and have the following field-adjustable settings:
1. Instantaneous trip.
  2. Long and short time pickup levels.
  3. Long and short time time adjustments.
- F. Main and Tie circuit breakers rated 1200-amp and greater shall be electrically operated draw-out type, rated 600 volts, 60 hertz, with a continuous current rating of 1,600-amps or 1200-amps as noted on the drawings, and an interrupting rating of 65,000-amps at 480 volts. All circuit breakers shall be ANSI power circuit breaker type. The mechanisms shall be of the stored energy type, normally charged by a universal electric motor, and be mechanically and electrically trip free. Provision shall be included for manual charging of the mechanism and for slow closing of the contacts for inspection or adjustment. The primary disconnecting fingers shall be silver-plated and retained to the primary contacts with individual leaf springs.
1. Switchboard main circuit breakers rated 1000 amps and greater shall be provided with ground-fault circuit protection.
    - a. Ground-fault protection with at least three short-time-delay settings and three trip-time-delay bands; adjustable current pickup. Arrange to provide Protection for the following:
      - (1) Three-wire circuit or system.
      - (2) Four-wire circuit or system.
      - (3) Four-wire, double-ended substation.

2. The secondary disconnecting contacts shall be silver-plated, multiple plug type, with automatic self-aligning sliding-type contacts. Provision shall be made to operate the breaker in either the operating or test positions.
3. Interlocks shall be provided to prevent movement of a closed breaker, to prevent closing of a breaker between operating and test positions, to trip breakers upon insertion or removal from the housing, and to discharge stored energy mechanisms upon insertion or removal from housing. The breakers shall be secured positively in the housing between and including the operating and test positions.
4. The switchboard main and tie circuit breakers will be connected to and controlled from the existing Power Monitoring Control System in Building 518 which was designed and installed by the HK Scholz Co. All control wiring, programming and interface to this system will be by the HK Scholz Co. See drawings for added detail.
5. Breaker control circuits shall be suitable for 120 volt AC operation and shall include all necessary limit and latch checking switches, interlocking switches, anti-pump mechanisms and control circuits, miscellaneous relays, test switches, etc., for proper operation. The breaker control circuits shall include a normally open contact of the limit switch for the spring charging motor and a normally closed contact of the trip latch checking switch, in addition to the normally supplied devices, in the closing circuit of the breaker.
6. The switchgear shall be furnished with the following accessories for testing, inspection, maintenance and operation including:
  - a. Accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance and operation.
  - b. Portable test set to test functions of solid-state trip devices without removal from switchboard. Include relay and meter test plugs suitable for testing switchgear meters and switchgear class relays.
7. Each breaker shall be equipped with the following features or accessories when viewed from the front:
  - a. Trip push button
  - b. Breaker contact position indication
  - c. Manual spring charging capability
  - d. Spring charge & discharge indication
  - e. Nameplate
8. Supplementary Equipment
  - (1) Breaker lifting yoke. The breaker lifting yoke shall securely attach to the breaker
  - (1) Maintenance handle for manually closing circuit breaker when not in the housing
  - (1) Levering crank for moving circuit breaker between test and connected positions.
  - (1) Spring charge handle for manually charging the closing spring

- (5) Spare indicating lamps for each type and color of lamp provided
  - (4) Spare fuses for each size/type of fuse provided
  - (1) Spare parts/maintenance equipment storage cabinet, lockable compartmental steel box or cabinet arranged for wall mounting
  - (1) Circuit Breaker Removal Apparatus: Portable, floor supported, roller-base, elevating carriage arranged for moving circuit breakers in and out of compartments.
- G. Identification: Each switch shall be equipped with engraved plastic nameplates identifying its load.
- H. Branch circuits for feeders and power loads shall consist of circuit breaker of type, size and rating as indicated on the drawings.
- 1. All main, tie and branch circuit breakers shall be fully rated and have a minimum interrupting rating of 65,000-amperes symmetrical at 480-volts.
- I. Provide each switchboard with a multifunction digital meter with mod bus RTU RS-485 communication interface. The meter shall be a microprocessor based unit suitable for 3- or 4-wire systems and have as a minimum the following features:
- 1. Switch-selectable digital display of the following:
    - a. Phase Currents, Each Phase: Plus or minus 1%.
    - b. Phase-to-Phase Voltages, 3-Phase: Plus or minus 1%.
    - c. Phase-to-Neutral Voltages, 3-Phase: Plus or minus 1%.
    - d. Three-Phase Real Power: Plus or minus 2%.
    - e. Three-Phase Reactive Power: Plus or minus 2%.
    - f. Power Factor: Plus or minus 2%.
    - g. Frequency: Plus or minus 0.5%.
    - h. Integrated Demand, (KWD or KVAD) with Demand Interval Selectable from 5 to 60 Minutes, set at 15 minutes: Plus or minus 2%, user resettable.
    - i. Accumulated energy, in megawatt hours (joules), plus or minus 2%; stored values unaffected by power outage for up to 72 hours.
  - 2. Mounting: Display and control unit flush or semi-flush mounted in switchboard.

## 2.3 SYNCHRONISM CHECK PROTECTION

- A. Separate synchronism check relays shall be provided for each 'Main' and 'Tie' circuit breaker in Distribution Switchboards. The synchronism relay shall monitor and enable/disable closure of the associated 'Main' or 'Tie' breaker for the purpose of defining operation. The 'Bus' side of any 'Main' or 'Tie' breaker shall be referring to the side attached to the switchboard

distribution section. Both 'Tie' breakers shall require closure in order to complete the tie connection between Distribution Switchboards.

1. Dead Line-Dead Bus: Any 'Main' circuit breaker shall have its close function enabled when both the line side and bus side of the circuit breaker are de-energized. Any 'Tie' circuit breaker shall have its close function disabled when both the line side and bus side of the circuit breaker are de-energized.
2. Dead Line-Live Bus: Any 'Main' circuit breaker shall have its close function disabled when the line side of the circuit breaker is de-energized and the bus side is energized. Any 'Tie' breaker shall have its close function enabled when the line side of the circuit breaker is de-energized and the bus side of the circuit breaker is energized.
3. Live Line-Dead Bus: Any 'Main' or 'Tie' circuit breaker shall have its close function enabled when the line side of the circuit breaker is energized and the bus side of the circuit breaker is de-energized.
4. Live Line-Live Bus: Any 'Main' or 'Tie' circuit breaker shall have its close function enabled when both the line side and bus side are energized if and only if the synchronism check relay senses that the Voltage, Amplitude, Frequency and Phase Angle are within the programmed limits of the synchronism check relay.
5. Remote Monitoring Contacts: The synchronism check relay shall have dry contacts for monitoring whether or not the close function is enabled.
6. Under/Over Voltage Monitor: The synchronism check relay shall also include under/over voltage monitoring as required to determine if the line and bus side of the 'Main' and 'Tie' breakers are energized or de-energized.

## 2.4 INSTRUMENTATION

### A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
2. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; bar or window type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

## 2.5 CONTROL POWER

### A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

- B. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.
- C. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.
- D. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

## 2.6 DC POWER SUPPLY

- A. Provide 48-volt DC power supply charger and batteries for main/tie breaker Bldg. 518 control/monitor system interface coordinate with H.K. Scholz Co., Mr. Ross Scholz, (402) 339-7600.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Installer must examine areas and conditions under which switchboards and components are to be installed and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

### 3.2 INSTALLATION

- A. Install switchboards as indicated, in accordance with manufacturer's written instructions, with recognized industry practices; complying with applicable requirements of NEC, NEMA's Standard PB 2.1 and NECA's "Standard of Installation".
- B. Coordinate with other work including electrical cabling/wiring work, as necessary to interface installation of switchboards with other work.
- C. Installation Pathway: Remove and replace building components and structures to provide pathway for moving switchgear into place.
- D. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A.
- E. Install fuses in switchboards, if any.

### 3.3 ADJUSTING AND CLEANING

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch-up scratched or marred surfaces to match original finishes.

### 3.4 GROUNDING

- A. Provide equipment grounding connections for switchboards as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective ground. Provide ground bus of ampacity equal to at least 30% of main bus rating.

### 3.5 FIELD QUALITY CONTROL

- A. Prior to energization of circuitry, check all accessible connections to manufacturer's tightening torque specifications.
- B. Prior to energization of switchboards, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.
- C. Prior to energization, check switchboards for electrical continuity of circuits and for short-circuits.
- D. Subsequent to wire and cable hook-ups, energize switchboards and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units and then retest to demonstrate compliance.
- E. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
  - 1. Inspect switchboard installation, including wiring, components, connections, and equipment. Test and adjust components and equipment.
  - 2. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 16 Sections.
  - 3. Complete installation and startup checks according to manufacturer's written instructions.
  - 4. Assist in field testing of equipment including pretesting and adjusting of equipment and components.
  - 5. Report results in writing.

### 3.6 ADJUSTING

- A. Set field-adjustable, protective-relay trip characteristics according to results in Division 16 Section "Overcurrent Protective Device Coordination."
- B. Set field-adjustable, protective-relay trip characteristics.

### 3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of switchgear. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.8 PROTECTION

- A. Temporary Heating: Apply temporary heat to switchgear, according to manufacturer's written instructions, throughout periods when switchgear environment is not controlled for temperature and humidity within manufacturer's stipulated service conditions.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchgear. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION